

REMARKS***I. Claims Status:***

Claims 1-3, 9-38 and 76-79 are pending.

Claims 76-79 have been added.

Claims 4-8 have been canceled.

Claims 39-75 have been withdrawn from consideration.

Claims 1, 3, 5, 13, 21, 29, 30, 32 and 38 have been amended.

II. Affirmation of Prior Election of Invention and Withdrawal of Claims 39-75

Applicant hereby affirms the prior election of Group I, claims 1-38, made in applicant's February 19, 2003 "Response to February 6, 2003 Office Action" in this patent application.

Correspondingly, applicants withdraw from consideration, non-elected Group II method claims 39-75, with the intent to rejoin those claims at a later time, or alternatively, with reservation of the right to file divisional application(s) directed to the subject matter of those claims if rejoinder is not effectuated.

Specifically, applicants intend to rejoin the withdrawn method claims 39-75 when the elected composition claims 1-387 (as herein amended, and as may subsequently be further amended) are determined to be allowable. Such rejoinder would be fully proper under these circumstances, for the following reasons:

When the application as originally filed discloses a product and the process for making and/or using such product, and only claims directed to the product are presented for examination, when a product claim is found allowable, applicant may present claims directed to the process of making and/or using the patentable product for examination through rejoinder procedure in accordance with MPEP §821.04, provided that the process claims depend from or include all the limitations of the allowed product claim.

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In this case, the elected claims 1-38 are directed to an abrasive free slurry composition having a pH in a range from about 0.1 to 6.9 and comprising an oxidizing agent, and a nitrilotriacetic acid or iminodiacetic acid, corrosion inhibitor. And the non-elected claims 39-75, directed to a method of using the abrasive free slurry composition; may be amended to expressly recite all the limitations included in the elected composition claims 1-38. Consistent with the provisions of MPEP §821.04, if the composition claims 1-38 are subsequently found allowable, the withdrawn method of use claims 39-75 may be rejoined for examination.

Therefore, applicants request the Examiner to take up the non-elected claims 39-75 for examination when claims 1-38 are allowed.

Alternatively, if the rejoinder of withdrawn claims 39-75 is denied, despite the proper basis in the MPEP therefor, applicants hereby reserve the right to file divisional application(s) directed to the subject matter of such withdrawn claims under 35 U.S.C. 121.

III. Response to Claim Rejections Under 35 U.S.C. § 112

In the March 31, 2003 Office Action, claims 3, 13, 21 and 30-38 were rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter, which applicant regards as the invention. Specifically,

in line 4 of claims 3, and 38, the term "periodate ammonium" should be replaced with "periodate, ammonium";

the last line of claim 13 is redundant upon the first 2 lines of claim 13;

the last part of claims 21, and 32 are missing;

claim 30 incorrectly depends upon claim 30 instead of claim 29 as it should;

in claim 13, applicant incorrectly lists compounds in a Markush group which are not tungsten based compounds as is claimed by the applicant; and

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in claim 30, applicant incorrectly recites zero concentration being possible for components which, must be present in the cmp slurry, which is claimed in the claim upon which the claim depends.

In response, applicant amends herein, claims 3, 13, 21, 30, 32 and 38 to correct the specific errors identified by Examiner Goudreau, as outlined hereinabove. Specifically,

claims 3, and 38, have been amended to insert a comma between the term "periodate ammonium";

claim 13 has been amended to delete reference to metal films other than tungsten;

claim 21 has been amended by adding text identifying further organic acids and claim 32 has been amended to add a period at the end;

claim 30 has been amended to depend from claim 29;

claim 13 has been amended to delete reference to metal films other than tungsten; and

claim 30, has been amended by replacing the limitation, zero concentration, with "up to" so as to expressly require the presence of the identified component in the slurry formulation.

The aforementioned amendments serve to overcome the rejections under 35 U.S.C. §112, second paragraph, as set forth in the March 31, 2003 Office Action. Accordingly, applicant respectfully requests withdrawal of the rejection and reconsideration of claims 3, 13, 21, 30, 32 and 38.

IV. Claims Rejections Under 35 U.S.C. § 102(e)

In the March 31, 2003 Office Action the following rejections were set forth:

claims 1, 3-5, 10-19, 21, 23-25 and 29 were rejected under 35 U.S.C. § 102(e) as being anticipated by United States Patent number 6,117,775 to Seiichi Kondo et al. (hereinafter referred to as "Kondo"); and

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claim 30 was rejected under 35 U.S.C. § 102(e) as being anticipated by United States Patent publication number 2002/0173221 to Shijian Li et al., (hereinafter referred to as "Li");

In response, applicant traverses Examiner Goudreau's rejections and submits that the claims as amended herein are patentably distinct from Kondo and Li and reconsideration of the patentability of pending claims 1, 3, 10-19, 21, 23-25, 29 and 30 is therefore requested, in light of the following remarks.

The present claims, as amended are directed to a formulation comprising an oxidizing agent and a nitrilotriacetic acid or iminodiacetic acid, corrosion inhibitor. The formulation having a pH in a range of from about 0.1 to 6.9 is free of abrasive.

Kondo and Li disclose abrasive free slurries, which according to Examiner Goudreau anticipate applicant's claimed invention.

Applicant has amended independent claim 1 to recite a nitrilotriacetic acid or iminodiacetic acid, corrosion inhibitor. Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim. *Lindermann Maschinenfabrik GMBH v. American Hoist and Derrick Co.*, 221 U.S.P.Q. 481, 485 (Fed. Cir. 1984). Kondo and Li do not meet this standard.

Thus, with specific reference to applicant's abrasive free slurry requiring a corrosion inhibitor being nitrilotriacetic acid or iminodiacetic acid, the Kondo or Li references, do not describe, either expressly or inherently, each and every element as set forth in applicant's claimed invention. Applicant therefore requests that the rejections of claims 1, 3, 10-19, 21, 23-25, 29 and 30, under 35 U.S.C. § 102(e) be withdrawn.

V. Claims Rejections Under 35 U.S.C. § 103(a)

In the March 31, 2003 Office Action the following rejections were set forth:

claims 1-38 were rejected under 35 U.S.C. § 103(a) as being unpatentable over United States Patent number 6,409,781 to William A. Wojtczak et al. (hereinafter referred to as "Wojtczak"); and

claims 1-6, 10-26, 29, 31-33 and 36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Li.

In response, applicant traverses Examiner Goudreau's rejections and submits that the claims as amended herein are patentably distinct from Wojtczak and Li, and reconsideration of the patentability of pending claims 1-3 and 9-38 is therefore requested, in light of the following remarks.

The present claimed invention relates to a formulation for use in chemical mechanical planarizing of metal films. The formulation is abrasive free, in a pH range from 0.1 to 6.9 and comprises an oxidizer and a nitrilotriacetic acid or iminodiacetic acid corrosion inhibitor.

The inventors of the present invention experimentally removed the abrasive component of a CMP slurry, and used the abrasive free formulation to chemical mechanically polish a wafer having deposited thereon a bulk copper layer from a damascene processing step. The inventors unexpectedly discovered that the particular combination of oxidizer and dicarboxylic acid corrosion inhibitor, removed the bulk copper layer at a rate $>3100 \text{ \AA}/\text{min}$ and as high as $4000 \text{ \AA}/\text{min}$ in preliminary testing. Such removal rates are not significantly different from the same formulation comprising abrasive. (See, the instant specification, pages 8 and 9).

Wojtczak describes a chemical mechanical polishing slurry for polishing copper, barrier material and dielectric material, where the slurry comprises silica particles, an oxidizing agent, a corrosion inhibitor and a cleaning agent.

With respect to Wojtczak, Examiner Goudreau states in the March 31, 2003 Office Action on page 9,

It would have been obvious to one skilled in the art to use a fixed abrasive pad in place of the free floating abrasive particles in the cmp slurry taught above to conduct the cmp polishing process taught above. It is conventional or at least well known in the arts to use a fixed abrasive polishing pad in combination with an abrasive free slurry to cmp polish a substrate. Further, this would have simply involved the usage of an alternative, and at least equivalent means for providing the physical action in a cmp polishing process to the specific means which are taught above.

Applicant's claimed abrasive free slurry removes copper containing materials at rates equivalent to Wojtczak. Moreover, the instant claimed invention, provides an abrasive free slurry having higher copper selectivity than Wojtczak. For example, Table 1, page 9 of the instant specification compares the Step 1 formulation of Wojtczak, which includes an abrasive, to the present abrasive free formulation. Copper removal rates are comparable and tantalum, tantalum nitride and thermal oxide selectivities increase from 1:10, 1:10 and 1:50 respectively to 1:500, 1:61, and 1:730 respectively.

Based on MPEP 2142, when establishing a *prima facie* case of obviousness, the teaching or suggestion to make the claimed combination must both be found in the prior art and not based on applicant's disclosure. Examiner Goudreau's suggestion that "it would have been obvious to use a fixed abrasive pad in place of the free floating abrasive particles to conduct the cmp polishing process taught above", is outside the scope of the current claims set, as applicant's claims are directed to a formulation and not a process.

MPEP 2144.04 Elimination of a Step or an Element and its Function (II, B) states, "omission of an element with retention of the element's function is an indicia of unobviousness."

Applicant has shown in Table 1, as identified above, polishing data for a copper containing thin film having comparable copper removal rates and unexpectedly improved selectivity. Accordingly applicant's invention is not obvious and patentably distinguished from Wojtczak.

With respect to Li, Examiner Goudreau states,

It would have been obvious to one skilled in the art to replace the BTA corrosion inhibitor used in the cmp slurry taught above with IDA based upon the following. The usage of IDA as a corrosion inhibitor in a cmp slurry is conventional or at least well known in the cmp arts. Further, this simply represents the usage of an alternative, and at least equivalent means which are taught above.

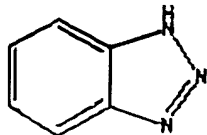
Li teaches at paragraph 53

One example of a suitable first polishing composition includes one or more chelating agents, one or more oxidizers, one or more corrosion inhibitors, one or more pH adjusting agents, a pH of about neutral, and deionized water.

Moreover, Li teaches at paragraph 56

Examples of corrosion inhibitors include any various organic compounds containing an azole group, such as benzotriazole, mercaptobenzotriazole, or 5-methyl-1-benzo-triazole.

Benzotriazole (BTA) has the following structure:



According to MPEP 2142:

To establish a *prima facie* case of obviousness, *three* basic criteria *must* be met. First, there must be some suggestion or motivation, either in the references them-selves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Examiner Goudreau's statement regarding the use of iminodiacetic acid as an equivalent alternative to Li's BTA is unfounded. Iminodiacetic acid is useful in inhibiting corrosion and in cleaning or solubilizing, oxidized metal surfaces.

As provided in applicant's specification, on page 11, the copper corrosion inhibitor

is defined as a substance that reacts with the oxidized copper thin film to passivate the copper layer and prevent excessive etching of the copper surface during CMP

and the cleaning agent is

defined as a substance that chelates to the copper, leading to soluble copper complexes that can be readily removed during polishing.

Further, iminodiacetic acid, a dicarboxylic acid having both acid and imine groups, functions as both a chelating agent and corrosion inhibitor.

Li, expressly requires one or more chelating agents and one or more corrosion inhibitors (See, paragraph 53). Moreover, Li does not teach or suggest an iminodiacetic acid corrosion inhibitor, but rather an azole corrosion inhibitor.

The Office must recognize that Li describes a suitable first polishing composition as including one or more oxidizers, one or more corrosion inhibitors, one or more pH adjusting agents, a pH of about neutral and deionized water (*See* paragraph 53). Li's corrosion inhibitor, which is defined by Li as "any various organic compounds containing an azole group" is critical to the polishing composition described therein and as such is part of Li's reference in its entirety.

Certain individual features from the references may not be arbitrarily chosen (while equally arbitrarily discarding other disclosed features) to merely lump together disparate features in an attempt to meet the features of the rejected claims. Thus, the Office must not pick and choose just certain parts of a reference, but instead, the reference in its entirety must be considered. Accordingly, the Office must recognize that Li describes a slurry composition having as a critical component, an azole corrosion inhibitor.

Such approach is improper and legally insufficient to establish any *prima facie* case of obviousness.

In conclusion and in light of the above discussion, applicants contend that the Office has not met its burden of establishing a *prima facie* case of obviousness. Accordingly, applicants respectfully request that the rejections based on Wojtczak and Li, of claims 1-3, 9-38 and 76-79 on the basis of obviousness, be withdrawn.

VI. Petition Under 37 CFR 1.136 for Three-Month Extension of Time

Petition hereby is made under the provisions of 37 CFR 1.136 for a three month extension of the term for response to the March 31, 2003 Office Action, extending the term for response to September 31, 2003.

VII. Fees Due and Payable

In connection with applicant's Petition Under 37 CFR 1.136 for Three Month Extension of Time, a fee of \$930 as specified in 37 CFR 1.17(a)(3), is hereby authorized to be deducted from the Deposit

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Account No. 50-0860 in the name of applicant, Advanced Technology Materials, Inc., 7 Commerce Drive, Danbury, CT 06810.

In connection with amendments to claims made herein, a net fee of \$168.00 (2 x \$84) is due as payment for addition of two independent claims. Applicant's original filing consisted of fifty five claims, three of which were independent. Currently, forty one claims are pending, five of which are independent. The Office is hereby authorized to deduct the \$168.00 fee from the Deposit Account No. 50-0860 in the name of applicant, Advanced Technology Materials, Inc., 7 Commerce Drive, Danbury, CT 06810.

CONCLUSION

Applicants have now made an earnest attempt to place this case in condition for allowance. For the foregoing reasons and for other reasons clearly apparent, Applicants respectfully request reexamination and reconsideration of this application and full allowance of claims 1-3, 9-38 and 76-79.

In the event that any issues remain outstanding, incident to the formal allowance of the Application, the Examiner is requested to contact the undersigned agent at (203) 794-1100 ext. 4184 to discuss their resolution, so that this application may be passed to issue at an early date.

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Respectfully submitted,



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